DOCUMENT RESUME

ED 477 054 IR 021 782

AUTHOR	Leighton, Chet; McCabe, Cynthia
TITLE	Authentic Performance of Complex Problem-Solving Tasks with an EPSS.
PUB DATE	2002-06-00
NOTE	6p.; In: ED-MEDIA 2002 World Conference on Educational Multimedia, Hypermedia & Telecommunications. Proceedings (14th, Denver, Colorado, June 24-29, 2002); see IR 021 687. Figures contain illegible type.
AVAILABLE FROM	Association for the Advancement of Computing in Education (AACE), P.O. Box 3728, Norfolk, VA 23514. Tel: 757-623-7588; e-mail: info@aace.org; Web site: http://www.aace.org/DL/.
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	Academic Achievement; Comparative Analysis; Corporations; Graduate Study; Higher Education; *Instructional Design; Masters Programs; Performance; Professional Development; *Training Methods
IDENTIFIERS	*Performance Improvement; *Performance Support Systems; San Francisco State University CA

ABSTRACT

Just-In-Time Learning (JIT Learning) is a semester-long graduate course that teaches corporate trainers and instructional designers how to design performance improvement interventions. This course is part of a Master's program in Instructional Technology at San Francisco State University. The course has been offered three times and has been completed by a total of 38 people. Learners produce two major deliverables for this course: a paper describing a performance problem and the design of a system to address the problem, and a shorter paper explaining the design strategy. Based on final grades for the course, participants in this class can be grouped into three broad categories. The A-level performers are 38% of the total students, B-level are 17%, and C-level are 45%. An Electronic Performance Support System (EPSS) was designed and implemented to help the B-level and C-level people improve their performance. The JIT Learning EPSS was designed and developed by Infomark Software Corporation with CGM Communications and assistance from several graduate students in the Department in the first half of 2001. The JIT Learning EPSS was implemented with 15 learners in Fall 2001. For this class the grade distribution was 53% in the A-level, 20% in the B-level, and 27% in the C-level. When compared with prior classes, all of the B-level performers improved to A-level and half of the C-level improved to B-level. A formative evaluation of the system was conducted in the winter of 2002. The results suggest that the remaining C-level performers do not have a sufficient mental model of the design task. The next version of the software will focus on helping users develop and assess their mental models before they begin the design task. Includes three color figures. (Author/AEF)

Reproductions supplied by EDRS are the best that can be made
from the original document.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

G.H. Marks

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Authentic Performance of Complex Problem-Solving Tasks with an EPSS

By Chet Leighton and Cynthia McCabe

ED 477 054

Teaching People to Design

Just-In-Time Learning (ITEC 805) is a semester-long graduate course that teaches corporate trainers and instructional designers how to design performance improvement interventions. This course is part of a Master's program in Instructional Technology at San Francisco State University. The course has been offered three times and has been completed by a total of 38 people. Learners produce two major deliverables for this course-- a paper of about 20 pages describing a performance problem and the design of a system to address the problem, and a paper of about 5 pages explaining the design strategy.

Based on final grades for the course, participants in this class can be grouped into three broad categories. The A-level performers are 38% of the total students, B-level are 17%, and C-level are 45%. An Electronic Performance Support System (EPSS) was designed and implemented to help the B-level and C-level people improve their performance. (See Leighton, 1996 for a description of the EPSS model.) The JIT Learning EPSS was designed and developed by Infomark Software Corporation with CGM Communications and assistance from several graduate students in the SFSU ITEC Department in the first half of 2001.

The JIT Learning EPSS was implemented with 15 learners in Fall 2001. For this class the grade distribution was 53% in the A-level, 20% in the B-level, and 27% in the C-level. When compared with prior classes, all of the B-level performers improved to A-level and half of the C-level improved to B-level. A formative evaluation of the system was conducted in the winter of 2002. The results suggest that the remaining C-level performers do not have a sufficient mental model of the design task. The next version of the software will focus on helping users develop and assess their mental models before they begin the design task.

Performance Support Systems for Complex Problem-Solving

Designing a performance improvement intervention is a moderately-structured complex problem-solving task (Foshay, 1997; Jonassen, 1997). Typically, a performance problem can be defined clearly, it is clear when the performance problem is solved, and there are multiple ways to design a correct solution.

There are numerous examples of performance support systems used to teach complex problem-solving tasks. There is a subset of cases where the user performs a task primarily involving design, analysis, and/or planning and the output of the task is to produce a deliverable document.

- Broadcast News allows high school students to write news story on real current events (Schank & Kass, 1996). The system includes a tool for writing stories, background information on a story, and a library of information resources. Video advising is provided based on the concept of goal-based scenarios.

- Project-Based Learning Support System (PBLSS) allows high school students to plan and conduct a math or scientific inquiry project (Laffey, Musser, and Tupper, 1998). The system includes guidelines for organizing a project, a tool for writing a project plan, and the ability to publish a project plan as an HTML document. PBLSS is designed to support project-based learning, where students work in groups to define and investigate their own project ideas.

- Air Campaign Planning Advisor (ACPA) allows U.S. Air Force officers to author air campaign plans to attack military targets (Johnson, Birnbaum, Bareiss, and Hinrichs, 2000). A seven-step model is used to structure the process. Information resources, including video-based advising, are organized around questions to address in producing an air campaign plan.

- Tactical Readiness Instruction, Authoring, and Delivery (TRIAD) allows U.S. Navy officers to create tactical documents that are used to share information on tactical problems and solutions (Hannafin, Hill, and McCarthy,

IR021782

BEST COPY AVAILABLE

2001). TRIAD includes an authoring tool for producing multimedia documents. An interview process is used to lead the user through writing the various sections of a document.

A common theme among these systems is support for two major activities. First, users must perform the complex problem-solving task that involves design, analysis, and/or planning. Second, users must perform the task of producing a deliverable document that contains the "output" of the problem-solving task.

Underlying the design of these systems is the concept of situated cognition and the Cognitive Apprenticeship framework (Brown, Collins, and Duguid, 1989; Collins, Brown, and Holum, 1991). The EPSS contains a tool for producing the deliverable and uses a series of guidelines and questions to scaffold task performance. Information resources are organized around sub-tasks in order to model performance. Coaching is implemented in several ways: the process is structured through an explicit task model, the guidelines and questions provide implicit structuring as performance occurs, and video-based advising appears in the context of authentic task performance.

The Just-In-Time Learning EPSS

The Just-In-Time Learning EPSS uses a six-step process to design a performance improvement intervention. The first five steps lead the learner through describing the problem situation and explaining the design of the proposed intervention. The last step reviews the design strategy of the intervention. This last step is used to support articulation and reflection on the current design effort, and to explore new design ideas for future efforts.

The format of a typical deliverable produced by the EPSS is like the format of this article. A paper is generated as a series of paragraphs with appropriate subheadings in HTML. The formatting of the document is simple, as the emphasis is on the content not on presentation. Of course, a user can import the HTML into a word processing program to improve the formatting.

Structuring the Performance and Learning Process

The opening web page for the EPSS shows the status of work on each step, or deliverable document. The web page for one of the deliverables is shown in Figure 1. The header across the top of the page reiterates all the steps in the process. Access to performance and learning resources are organized around producing the deliverable.

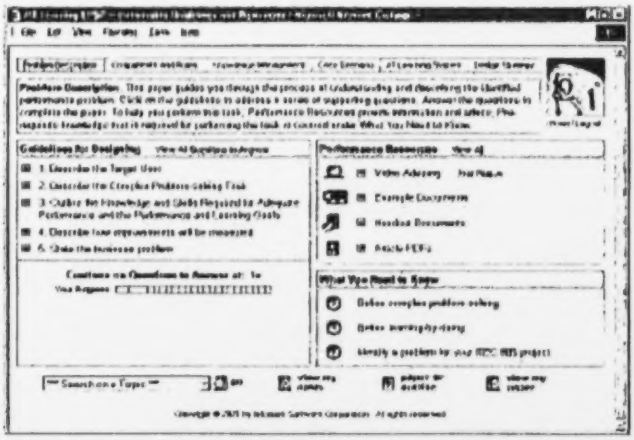


Figure 1 – Guidelines and Resources for Producing a Deliverable Document

Resources for a deliverable are organized into three categories, as noted below. The user clicks a ⊞ symbol to see the questions under a guideline or the documents for a type of resource.

- Guidelines and specific questions to answer in producing the deliverable document

BEST COPY AVAILABLE

- Performance Resources-- Advice on key design decisions, example documents, and information resources in the form of handout documents and articles to read
- What You Need to Know-- These learning topics represent pre-requisite knowledge required in order to understand how to use the resources and produce the deliverable.

The items under "What You Need to Know" correspond to the learning objectives of the JIT Learning course. A learning topic has information resources like article readings, text discussions, and handout documents. It also includes exercises (self-graded) and assignments (graded by the instructor) for practice. These learning topics allow learners to review the information provided in class.

Scaffolding Task Performance

The combination of guidelines and questions structure the task of writing each deliverable document. By clicking on any question (or the question number following "Continue on Questions to Answer at:") the user can enter an answer for a question as shown in Figure 2.

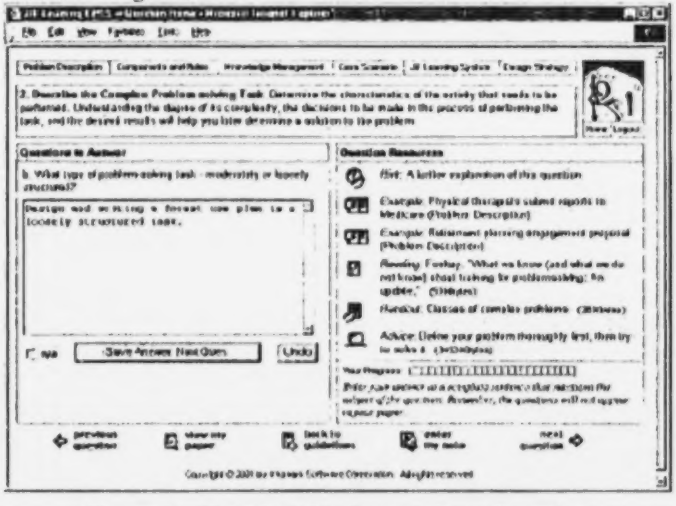


Figure 2 – Entering the Answer for a Question

The software simplifies the task of writing a document by prompting a user to answer a series of questions. When the user clicks "Save" an answer is saved in a relational database. Then the user is prompted to answer the next question. A progress meter showing how many questions have been answered for the deliverable appears on both the Deliverable and Question pages.

At any time the user may click "View My Paper" to produce the output document. All o f the individual answers are compiled into a series of paragraphs. Users can save documents in HTML format and import them into a word processing program for additional formatting or revision.

Another scaffold in the system concerns the ability to prepare an outline before writing a paper (via the "Paper or Outline" button in Figure 1). In outline mode, the user's answers are shown side-by-side in a two-column table with the questions. The learner can submit an outline version, get feedback from the instructor, and then revise the outline into a narrative paper.

There are multiple levels to fading these scaffolds. The learner can skip producing an outline and move directly to writing a paper. The learner does not have to use the question and answer page as the writing tool. The Deliverables page could serve as an external support facility and the user could work entirely in a word processing program. By design, the fading of the scaffolds is controlled by the user.

BEST COPY AVAILABLE

Coaching and Advising

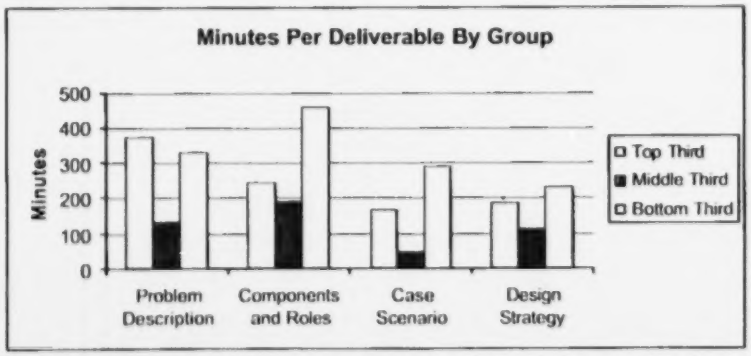
Video-based advising takes the form of 45 to 90 second video clips with advice on the most frequently encountered design problems for a deliverable. This advising is in the form of a story about a design problem. Most of the videos feature learners who have completed the course telling their own painful stories. They describe a problem situation and then discuss their solution. There are also clips featuring the advice of the instructor. The instructor describes a symptom, the underlying problem, and advice on how to solve that problem. For example, one video clip explains the trap of starting to design the solution before the problem is fully defined.

Formative Evaluation Results

A formative evaluation of the EPSS was conducted in the winter of 2002. Data was collected from twelve participants with a 70-point questionnaire, from database log files with details on how the software was used, and with follow-up interviews.

The average amount of time spent writing papers with the system was 927 minutes, or about 15½ hours. When the participants are ranked by final grade, the top third spent an average of 975 minutes, the middle third spent 494 minutes, and the bottom third spent 1,313 minutes. The following chart shows the average amount of time spent on each of the four major papers (Deliverables) by group. The differences are quite obvious between the three groups. The top group put most of their effort into the problem description, while the bottom group spent most of their time on describing the solution (the Components and Roles and Case Scenario papers). The middle group appears to be quite efficient in using their time. In contrast, given the low quality of their design efforts, the bottom group spent a lot of unproductive time in devising a solution.

On the questionnaires, the bottom group scored themselves higher than the top group in using the feedback from the instructor to improve their project designs. However, their final grades were lower primarily because they did not correct the design flaws identified in feedback on their papers. The Case Scenario papers by the bottom group revealed a weak understanding of the task being performed by their target users. Surprisingly, the bottom group claimed to have more experience doing task analysis than the top group. Even though this topic is covered in a prerequisite course on the ISD model, the bottom group appears to have a weak understanding of task analysis. This



limits their ability to effectively use the instructor's feedback in defining problems and designing solutions.

Implications and Future Work

The approach of using guidelines and questions to scaffold the task of writing complex papers was successful in helping improve the overall performance of a class. However, there is still a group at the bottom of the class that needs more help than the EPSS provided. They spend too little time in defining the problem situation and too much time in creating a solution. At the same time, they do not make effective use of the instructor's feedback in correcting design flaws.

This suggests that users who perform poorly have weak mental models of the design task. In the next version of the JIT Learning EPSS we will add functions to help users develop and assess their own mental models before they begin producing a deliverable paper. This will include more emphasis on using the analysis of a target user's task to

better understand the problem domain. We will also add a feedback-and-response function so that users explicitly acknowledge the instructor's feedback and articulate how they will correct design flaws.

Bibliography

Brown, J. S., Collins, A., & Duguid, P. (1989). "Situated cognition and the culture of learning." Educational Researcher, 18(1), 32-42.

Collins, A., Brown, J. S., & Holum, A. (1991). "Cognitive apprenticeship: Making thinking visible." American Educator, 15(3), 6-15, 38-46.

Foshay, R. (1997). "What we know (and what we don't know) about training for problemsolving: an update." Performance & Instruction, 36(3), 40-45.

Hannafin, M. J., Hill, J. R., McCarthy, J. E. (2000). Designing resource-based learning and performance support systems. In D. A. Wiley (Ed.), The Instructional Use of Learning Objects. Bloomington, IN: Association for Educational Communication and Technologies.

Johnson, C., Birnbaum, L., Bareiss, R., & Hinrichs, T. (2000). "War stories: Harnessing organizational memories to support task performance." intelligence: New Visions of AI in Practice, 11(1), 16-31.

Jonassen, D. (1997). "Instructional design models for well-structured and ill-structured problem-solving learning outcomes." Educational Technology Research & Development, 45(1), 65-94.

Laffey, J., Tupper, T., Musser, D., & Wedman, J. (1998). "A computer-mediated support system for project-based learning." Educational Technology Research and Development, 46(1), 73-86.

Leighton, C. (1996). "What is an EPSS?" NCR Information Products Journal, 11(2), 7-9. Online Version Retrieved October 24, 2001 from the World Wide Web: http://www.itec.sfsu.edu/People/Faculty/cleighton/whatisepss.htm.

Schank, R. C., & Kass, A. (1996). "A goal-based scenario for high school students." Communications of the ACM, 39(4), 28-29.

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

NOTICE

Reproduction Basis

[X] This document is covered by a signed "Reproduction Release (Blanket)" form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

[ ] This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").